State of Wisconsin/Department of Transportation

RESEARCH PROGRESS REPORT FOR THE QUARTER ENDING: Mar 31, 2002

Program: SPR-0010(36) FFY99	**Part: II Research and Development**
Project Title: HMA Moisture Damage as it Relates to Pavement Performance	**Project ID:** 0092-01-03
Administrative Contact: Nina McLawhorn	**Sponsor:**
WisDOT Technical Contact: Error! Bookmark not defined.	**Approved Starting Date:** Nov 15, 2000
Approved by COR/Steering Committee: $50,753.00	**Approved Ending Date:** May 15, 2002
Project Investigator (agency & contact): Hussain Bahia: UW-Madison	

Description: Error! Bookmark not defined.

Total study budget	Current FFY budget	Expenditures for current quarter	Total Expenditures to date
$50,753.00	**$25,376.50**	**$0.00**	**$0.00**

Progress This Quarter:

(Includes project committee mtgs, work plan status, contract status, significant progress, etc.)

The work accomplished last quarter was focused on the following topics:

1. Cost Analysis

The cost of using anti-stripping additive in the mixtures, the additional cost of TSR testing, and the safety concerns when using additives were compared to the cost of maintenance including repairing possible distresses due to not using of anti-stripping additives, after a specifed pavement life. Table 1 and 2 illustrate the cost estimation for asphalt pavement with anti-stripping additive, and with maintenance (no anti-stripping additive) respectively. The final costs show only small marginal difference between the life cycle cost of a pavement with and without using additives. It should be noted that cost is for a specifc mixture design and therefore, different amount of material required per mix design could result in different final cost estimations.

Table 1 Estimated Cost for Asphalt Mix with Anti-Stripping Additive

Standard Pavement Structure with Anti-Stripping Additive *Design Life = 18 years*	- Asphalt mix cost = $19.18 / ton - Safety cost = $0.07 / ton - Additive = $0.70 / ton (Average) - TSR Testing (before and after adding anti-stripping additive) = $1,150 / mix design The total is two mix designs 1. Upper layer – 12.5 mm, 1.75 in. thickness 2. Lower layer – 19 mm, 2.50 in. thickness			
	5,000 ton / mix design	***10,000 ton / mix design***	***30,000 ton / mix design***	***75,000 ton /***
	- TSR Testing = $0.46 / ton - Total cost = $20.41 / ton = $20.41 / 20 = $1.021 ft^3	- TSR Testing = $0.230 / ton - Total cost = $20.18 / ton = $20.18 / 20 = $1.009 ft^3	- TSR Testing = $0.076 / ton - Total cost = $20.026 / ton = $20.026 / 20 = $1.001 ft^3	- TSR Testi ton - Total cost = $19.98 / 2

	(1 ton = 2200 lbs, unit weight of asphalt mixture = 110 lb / ft^3, 1 ton = 20 ft^3) - Assume the pavement of 4.25 inches thickness, and 26 feet lane width			
	= \$1.021 x 26′ x 0.354′ = \$9.397 / ft **= <u>\$49,620 / mile</u>**	= \$1.009 x 26′ x 0.354′ = \$9.287 / ft **= <u>\$49,035 / mile</u>**	= \$1.001 x 26′ x 0.354′ = \$9.213 / ft **= <u>\$48,645 / mile</u>**	= \$0.999 x 2 \$9.195 / ft **= <u>\$48,550 /</u>**
<u>Typical Overlay with Anti-Stripping Additive</u>	- Asphalt mix cost = \$19.18 / ton - Safety cost = \$0.07 / ton - Additive = \$0.70 / ton (Average) - TSR Testing (before and after adding anti-stripping additive) = \$1,150 / mix design			
	5,000 ton / mix design	***10,000 ton / mix design***	***30,000 ton / mix design***	***75,000 ton /***
	- TSR Testing = \$0.23 / ton - Total cost = \$20.18 / ton = \$20.18 / 20 = \$1.009 ft^3	- TSR Testing = \$0.115 / ton - Total cost = \$20.065 / ton = \$20.065 / 20 = \$1.003 ft^3	- TSR Testing = \$0.038 / ton - Total cost = \$19.988 / ton = \$19.988 / 20 = \$0.999 ft^3	- TSR Testin - Total cost = = \$19.965 /
	- Assume the overlay of 3.5 inches thickness, and 26 feet lane width			
	= \$1.009 x 26′ x 0.292′ = \$7.652 / ft **= <u>\$40,400 / mile</u>**	= \$1.003 x 26′ x 0.292′ = \$7.615 / ft **= <u>\$40,206 / mile</u>**	= \$0.999 x 26′ x 0.292′ = \$7.584 / ft **= <u>\$40,046 / mile</u>**	= \$0.998 x 2 \$7.577 / ft **= <u>\$40,005 /</u>**

Table 2 Estimated Cost for Asphalt Mix with Maintenance (No Anti-Stripping Additive)

Standard Pavement Structure with Maintenance (No Anti-Stripping Additive *Design Life = 18 years*	- Asphalt mix cost = \$19.18 / ton - Safety cost = \$0.07 / ton - TSR Testing = \$575 / mix design The total is two mix designs 3. Upper layer – 12.5 mm, 1.75 in. thickness 4. Lower layer – 19 mm, 2.50 in. thickness			
	5,000 ton / mix design	***10,000 ton / mix design***	***30,000 ton / mix design***	***75,000 ton /***

	- TSR Testing = $0.23 / ton - Total cost = $19.48 / ton = $0.974 ft^3	- TSR Testing = $0.115 / ton - Total cost = $19.365 / ton = $0.968 ft^3	- TSR Testing = $0.038 / ton - Total cost = $19.288 / ton = $0.964 ft^3	- TSR Testi ton - Total cost = $0.963 ft^3
	- Assume the pavement of 4.25 inches thickness, and 26 feet lane width			
	= $0.974 x 26′ x 0.354′ = $8.965 / ft = $47,333 / mile	= $0.968 x 26′ x 0.354′ = $8.909 / ft = $47,042 / mile	= $0.964 x 26′ x 0.354′ = $8.873 / ft = $46,848 / mile	= $0.963 x 2 $8.863 / ft = $46,800 /
	- Maintenance cost (Seal coat) for every 5-6 years, or approximately 3 times in 18 years = 3 x $10,000 per lane mile = 3 x $384.62 / mile = $1,153.86 / mile			
	Total cost = **$48,487 / mile**	Total cost = **$48,196 / mile**	Total cost = **$48,000 / mile**	Total cost =

2. Adhesion Testing Using the PATTI Device

The adhesion testing of asphalt binder was conducted using the PATTI device. The experimental procedure allows measuring the tensile and bonding strength of asphalt binder that has been applied to an aggregate surface before and after exposure to water for various times of exposures. The procedure includes applying the asphalt binder to a pull stub, which is then pressed onto the aggregate surface. The pressure necessary to debond the conditioned specimen at 25 °C is measured with a pneumatic adhesion tester. Asphalt binder of the PG 58-28 garde was used, and 0.5% of the Morlife 3300 was selected as the anti-stripping agent in this test. Aggregate surfaces were prepared by obtaining a large pieces of rocks from various cources and cutting the rock to provide a smooth surface of the rock to represent aggregates. These rocks were obtained from the Geology Department at UW-Madison, with the required mineralogy corresponding to the different mineralogies that represent Wisconisn aggregate sources, as stated in the previous quarterly report.

Table 3 shows the experimental design for the adhesion test of asphalt binder with and without anti-stripping additive (Yes or No) using four aggregate sources (Platteville, Galena, Silurian, or Prairie Du Chein Dolomite). The testing was doen before and after water conditioning for different time intervals (0, 6, 24, 48 hours). The results of this test are almost completed. The analysis and conclusion will be included in the final report.

Table 3 Experimental Design for Adhesion Testing

Conditioned Time in Water (hrs)	**Platteville (P)**		**Galena (G)**		**Silurian (S)**		**Prairie Du Chein (PDC)**	
	No	**Yes**	**No**	**Yes**	**No**	**Yes**	**No**	**Yes**
0	P0-N	P0-Y	G0-N	G0-Y	S0-N	S0-Y	PDC0-N	PDC0-Y
6	P6-N	P6-Y	G6-N	G6-Y	S6-N	S6-Y	PDC6-N	PDC6-Y
24	P24-N	P24-Y	G24-N	G24-Y	S24-N	S24-Y	PDC24-N	PDC24-Y
48	P48-N	P48-Y	G48-N	G48-Y	S48-N	S48-Y	PDC48-N	PDC48-Y

3. Final Report

A draft of final report is being prepared. It should be completed by the beginning of May 2002. A no-cost time extensio will be applied for to allow the TOC members to review the reports and for the research team to revise the final report.

Work Next Quarter:

- Prepare documents for the final report.
- A meeting with the TOC committee will be held in late May to review the final report.
- Discuss the results or any problems that might occur during the preparation of the final report with the WisDOT representative.

Circumstances affecting progress/budget:

Gantt Chart:

PROJECT I.D.	STARTING DATE	COMPLETION DATE	MONTH	REPORT #
PROJECT # WISDOT	**NOV 01, 2000**	**APRIL 30, 2002**	**S E P 0 1**	4

CONSULTANT FIRM NAME	% TIME ELAPSED	TOTAL PROJECT FUNDING	CONTRACT FUNDING
UNIVERSITY OF WISCONSIN - MADISON	29.00%		100 %

NAME OF STUDY

EVALUATION OF THE EXTENT OF HMA MOISTURE DAMAGE IN WISCONSIN AS IT RELATES TO PAVEMENT PERFORMANCE

TASK *	YEAR / MONTH	2000 Qtr 1	2001 Qtr 2	2001 Qtr 3	2001 Qtr 4	2001 Qtr 5	2002 Qtr 6	2002 Qtr 7	PERCENT OF Project	PERCENT OF Task Complete Last Report	PERCENT OF Task Complete This Report	PERCENT OF Project Complete
TASK 1 : Collect data and Conduct Data Analysis									20	0	100	20
TASK 2 : Assessment of the Moisture Damage Problem									34	0	100	34
TASK 3 :												
3.1 : Use and Cost of Additives									15	0	100	15
3.2 : Interim Report Meeting									2	0	100	2
TASK 4 : Expansion of Previous Study Implementation Plan									15	0	80	12
TASK 5 :												
4.1 : Final Report and Recommendations									10	0	50	5
4.3 : Meeting with the TOC									2	0	0	0
4.4 : Final Report Submittal									2	0	0	0
SHOW PROGRESS BY USE OF A BAR CHART:	SCHEDULED											

	COMPLETED		100			88

Note: Gantt chart shown in State Fiscal Year Quarters